

# The Potential of Turfgrass Growth Regulators In Water Conservation

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Plant growth regulators (PGRs) have been used to suppress turfgrass growth and seedhead formation since their introduction in the 1950s. The development of new PGRs in recent years has led to new research areas such as clipping reduction, water savings, improved turf quality and stress tolerance. The following is an overview of PGRs and their use as a turf management tool.

The first PGR to be used on turf was maleic hydrazide (Slo-Gro), developed in the 1950s. Its potential for phytotoxicity limited its use to turf areas such as highway roadsides and right of ways. Mefluidide (Embark) was introduced in the 1970s, and it was the first PGR to be extensively tested on high maintenance turf areas like golf courses and commercial lawn sites.

Flurprimidol (Cutless), paclobutrazol (Scott's TGR) and amidochlor (Limit) were developed in the 1980s. Various herbicides such as metsulfuron-methyl (Escort), imazapyr+imazethapyr (Event), sulfometuron (Oust), sethoxydim (Poast), glyphosate (Roundup), EPTC (Shortstop) and chlorsulfuron (Telar) were also used to suppress seedheads and growth in lower maintenance turf areas like highway roadsides. The newest PGR to date is Primo, registered in 1993. Unlike the other PGRs, Primo is used exclusively on fine turf areas like golf courses, athletic fields, sod farms and home lawns.

## How Do PGRs Work?

It is important to review PGR mode of action because the way they work determines the type of turf setting they can be used. Plant growth regulators suppress growth by stopping cell division or by slowing cell elongation. Gibberellic acid (GA) is a plant organic acid that aids in cell elongation. Some PGRs slow gibberellic acid production.

In the past, PGRs were classified as Type I (cell division inhibitor) or Type II (gibberellic acid inhibitor). A more detailed classification is currently being adopted where PGRs are classified as Class A, B, C, or D. Class A PGRs (Primo) stop the production of gibberellic acid late in the biosynthetic pathway. This is important as there are over 100 forms of gibberellic acid in plants. Most of them contribute to the formation of GA20 which converts to GA1 — the final form of gibberellic acid which is the one that functions in cell elongation. Primo stops the conversion of GA20 to GA1. The other 100-plus forms of GA are allowed to carry on their respective plant processes.

This is likely a key reason why Primo can be used on high maintenance turf, because potential for phytotoxicity is minimal. Primo is absorbed by the foliage within one hour of application. Class B PGRs (flurprimidol and paclobutrazol) stop the production of all forms of GA early in the biosynthetic pathway. They are used on moderate to highly maintained turf, and are root absorbed. Class C PGRs (maleic hydrazide and mefluidide) stop cell division. They can do a good job of stopping seedhead production when applied at the correct time. Class D PGRs include herbicides that are used as PGRs. They are not used on high maintenance turf.

## PGR Research

With the development of flurprimidol and paclobutrazol in the 1980s, and Primo in 1993, their potential for use on high maintenance turf led to new areas of research. Several states had enacted regulations that banned green waste in landfills. Research was conducted to determine if PGRs could reduce mowing and clipping production in high maintenance turf areas. If mowing

could be reduced, it was reasoned that equipment could last longer.

There were several challenges to overcome to make PGRs a part of routine turf maintenance. First was convincing turf managers that PGRs work. Many had heard or seen reports where PGRs performed poorly or were inconsistent. They often grouped PGRs as all alike with no difference in mode of action.

Others lacked a fundamental understanding of plant physiology and how plants grow. They did not understand how a chemical applied to a plant could slow its growth. Some referred to PGRs as another "snake oil." Foremost, many turf managers did not want to slow turf growth, since they make their living by mowing. A reduction in growth could mean reduced business.

Dramatic growth in the turf industry in the past decade was fueled in part by the popularity of golf. The demand for more golf courses brought about the demand for better quality turf. To accomplish this, improvements were made in a number of areas. New turfgrass cultivars, computerized precision irrigation systems, computerized business and turf management programs, safer pesticides for the environment, better maintenance equipment, and other factors have all contributed to the advance of better turfgrass. Plant growth regulators can also be included in the list of improvements.

## PGRs Can Mean Water Savings

The potential for PGRs to reduce turf water use was not known until they were used on high maintenance turf areas. These areas usually have a quality irrigation system and often some type of device to monitor evapotranspiration (ET). Turf quality could be monitored and correlated to the irrigation needed to maintain that quality. Researchers hypothesized if a plant grew slower and had smaller leaves, it might not require as much water to maintain turf quality.

Primo has gained wide acceptance as a tool to reduce mowing in areas like Florida that receive a

lot of rain — and in places where mowing is a frequent, year-round task. On the other hand, turf managers who have used Primo in areas of little rainfall, or in areas where turf irrigation is restricted, have reported Primo-treated turf has better quality during drought stress.

Research studies at Texas A&M University, Cornell University, University of California-Riverside, Colorado State University and Kansas State University have determined the influence of Primo in reducing water requirement. These studies have ranged from greenhouse trials to field experiments with lysimeters. Results have shown Primo can reduce water requirement from 7 to 26 percent. These results are supported by comments from numerous customers.

## Reducing the water requirement

Research with Primo shows that while turf vegetative growth is reduced, root growth is enhanced. This makes more of the soil moisture available to the plant and less leaf area for transpiration. Stomates may remain closed longer, which could also reduce transpiration. There are likely other reasons that hope to be defined with future research.

Most turf managers must work within the parameters of a budget and are hesitant to use unfamiliar products. Plant growth regulators like Primo have gained wide acceptance and their use continues to increase. Turf managers report that while it is initially an "add-on" item into their budget, they feel Primo pays for itself in labor savings, increased equipment life and potentially with water savings.

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